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Put $m=1$; then a=any value between $a>3$ and $a=10\frac{1}{2}$.
Put $a=4$; then $n=4, p=7$,
$x=13\frac{2}{3}$ ane $y=\frac{1}{3}$;
$\therefore mx=13\frac{2}{3}$, $nx=54\frac{2}{3}$, and $px=95\frac{2}{3}$.

Put $m=2$; then a=any value between $a>3$ and $a=5\frac{1}{2}$.
Put $a=4$; then $n=8, p=14$,
$x=7$ and $y=\frac{1}{3}$;
$\therefore mx=14$, $nx=56$, and $px=98$.

For want of space, we will let the reader solve for sets of values when $m=0$, $m>4$, and $a<3$. The discussion of these values may prove interesting.

Also solved by *H. W. DRAUGHON.*

13. Proposed by H. C. WHITAKER, B. S., M. E., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.

Six city boys, Jim, Josh, Jerry, Jack, Jake and Jeorje went into the country to steal apples from a tree. While three kept watch, the other three climbed up and got what they wanted. Then they came down while the other three rascals went up and stole. The one that got most was one of 'the last to go up.

Each trio of theives took the same number and had each boy taken as many as he did take in *each of that number of pockets*, each trio would also have taken the same number and the tree would have lost 538 apples. As it was, Josh got more than Jack, but Jeorje got as many as Josh and Jack together, while Jake got twice as many as Jerry and two more than Jim. What were the names of the three that first kept watch ?

Solution by H. W. DRAUGHON, Clinton, Louisana.

Let x= Jack's share, y= Josh's share and z=Jerry's share. Then from the conditions, $x+y$=Jeorje's share, $2z$=Jake's share, and $2z-2$=Jim's share. To find each share in integers, we must separate $\frac{1}{2}\times538=269$,—the numbers each trio would have taken,had the number in each share been squared, into 2 sets of 3 square numbers the sum of the roots in the two sets being equal. We easily find the required numbers to be, $(13)^2$, $(8)^2$, $(6)^2$, and $(12)^2$, $(10)^2$, $(5)^2$. Since the greatest root is 13, the boys who took respectively 13, 8, and 6 apples compose the trio who first kept watch. Comparing our results with the expressions for each boy's share given above, we find,

First trio;—Jerry, Jeorje, and Josh; respective shares;—6, 13, 8. Second trio;—Jack, Jake, and Jim; respective shares;—5, 12, and 10.

$\therefore$ Jerry, Josh and Jeorje first kept watch.

Also solved by *A. L. FOOTE, H. C. WHITAKER*, and *G. B. M. ZERR.*

PROBLEMS.

21. Proposed by Professor J. F. W. SCHEFFER, A. M., Hagerstown, Maryland.

A tobacconist has two kinds of smoking tobacco, of which the price of the better kind is $1 and of the inferior $.75 per ℔. Now, he takes 9 parts of the better and mixes it with 2 parts of the inferior, then 9 parts of the mixture with 2 parts of the inferior, etc. What is the price of the *nth* mixture per ℔.?

22. **Proposed by F. P. MATZ, M. A., M. Sc., Ph. D., Editor of the Department of Mathematics in the "New England Journal of Education" and Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.**

For the sum $D=\$30$, Messrs. Zerr and Ellwood contracted to plough the sod for a circular track, width $m=60$ feet and inner radius $r=940$ feet. How is the money to be divided, if they commence ploughing at the inner circumference of the track, make uniform furrows of width $n=1\frac{1}{3}$ feet, and Mr. Ellwood continually follows Mr. Zerr during the ploughing?

Solutions to these problems should be received on or before July 1st.

GEOMETRY.

Conducted by B. F. FINKEL, Kidder, Mo. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

6. **Proposed by EARL D. WEST, West Middleburg, Logan County, Ohio.**

Having the sides 6, 4, 5, and 3 respectively of a trapezium, inscribed in a circle, to find the diameter of the circle.

II. **Solution by Professor G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia; and J. A. CALDERHEAD, Superintendent of Schools, Limaville, Ohio; and CHARLES E. MYERS, Canton, Ohio.**

Let $ABCD$ be the quadrilateral inscribed in a circle, AC the diagonal, $AB=a=5$, $BC=b=3$, $DC=c=6$, and $DA=d=4$.

From the triangles ABC and CDA

$$AC^2=a^2+b^2-2ab\cos B$$

$$AC^2=c^2+d^2-2cd\cos D=c^2+d^2+2cd\cos B$$

$$\therefore\ \cos B=\frac{a^2+b^2-c^2-d^2}{2(ab+cd)}.$$

$$\text{Sin}^2 B=1-\frac{(a^2+b^2-c^2-d^2)^2}{4(ab+cd)^2}$$

$$=\frac{(c+b+d-a)(a+b+d-c)(a+c+d-b)(a+b+c-d)}{4(ab+cd)^2}$$

$$=\frac{16(s-a)(s-b)(s-c)(s-d)}{4(ab+cd)^2}\quad\text{where } s=\tfrac{1}{2}(a+b+c+d)$$

$$AC^2=c^2+d^2+\frac{2cd(a^2+b^2-c^2-d^2)}{2(ab+cd)}=\frac{(ac+bd)(ad+bc)}{(ab+cd)}.$$